

STACK TEST PLAN

FOR

EMISSION TESTING FOR MACT AND NSPS
STANDARD REQUIREMENTS

THE BATTERY RECYCLING COMPANY
ARECIBO, PUERTO RICO

June 7, 2010

CONTENTS

1.0	PROJECT BACKGROUND	1
2.0	EMISSION TESTING METHODOLOGY	2
3.0	FIELD TESTING METHODS AND PROCEDURES	3
3.1	Introduction	3
3.2	Sample Port Locations	3
3.3	Gas Flow and Temperature Measurements	6
3.4	Molecular Weight Determinations	6
3.5	Moisture Determinations	6
3.6	Inorganic Lead Testing	6
3.7	Sulfur Dioxide Testing	6
3.8	Hood Face Velocities using a Propeller Anemometer	6
3.9	Operating Data	7
3.10	Sampling Results	7
4.0	QUALITY ASSURANCE AND QUALITY CONTROL	8
4.1	Program Quality Control	8
4.2	Equipment Calibration	8
5.0	TESTING SCHEDULE	9
6.0	REPORT PREPARATION	10

APPENDICES

Appendix A Example Field Data Sheets

TABLES

Table 1	EPA Test Methods	3
Table 2	Sample Traverse Points – Baghouse Exhaust Stack	5

FIGURES

Figure 1	Baghouse Exhaust Stack Sample Port Locations	4
----------	--	---

1.0 PROJECT BACKGROUND

The Battery Recycling Company (BRC) owns and operates a lead recycling facility in Arecibo, Puerto Rico. BRC's operations are subject to the requirements of 40 CFR Part 63, Subpart X (National Emission Standards for Hazardous Air Pollutants from Secondary Lead Smelting, "Secondary Lead Smelting MACT Standard").

At its facility, BRC currently operates one rotary furnace and five refining kettles. The emissions from the existing furnace and refining kettles are controlled by an existing eight compartment baghouse. The baghouse system for the existing furnace and kettles was tested and demonstrated compliance with all applicable federal and state requirements.

This testing protocol is provided as part of BRC's plans to conduct sampling for emissions from the new rotary furnace and the four additional kettles at its facility. The emissions from the new rotary furnace and kettles will be controlled by a new additional eight compartment baghouse. The objective of the testing is to achieve five compliance objectives. The first two objectives are to determine if the new furnace and kettle emissions are in compliance with the 0.022 grains/dry standard cubic foot (gr/dscf) PM requirement, and the <20% opacity requirement, as set forth in the NSPS Standard Requirement 40 CFR 60.122(a). The third objective is to test the new baghouse to confirm compliance with the lead emission limit of 0.00087 grains of inorganic lead per dry standard cubic foot. The fourth objective is to verify that the face velocity of the emission control hoods on the lead taps/molds and slag tap/molds of the new facility kettles is >300 feet per minute (fpm), as required in the MACT Standard 40 CFR 63.544. The fifth objective is to measure the sulfur dioxide (SO₂) emissions from the second furnace and kettles to develop an SO₂ emission factor for the new units. This protocol presents these test objectives along with the description of the procedures that will be used to collect the data.

Secondary lead smelting at BRC includes three major operations: scrap pretreatment, smelting, and refining.

Scrap pretreatment is the partial removal of metal and nonmetal contaminants from lead-bearing batteries. After their receipt, batteries are sent to a milling machine that shreds the plastic battery housing and separates the remaining battery components in water by their densities. The separation process produces solid lead (cell plates), lead oxide, separators, and plastic. This process sends the water and electrolytes to a waste water plant at the facility.

Once dried, the lead-containing separated components will be fed to one of the two rotary furnaces for smelting. The rotary furnaces will be fired with used oil. Certain additives (soda ash, coal, etc.) are blended with the lead-containing components to achieve the desired properties of the product. Slag is removed from the furnaces, and the molten lead is then transferred to the corresponding kettles for further refining (adding various constituents to achieve desired product properties). During the refining process, waste dross is skimmed from the top of the kettles and removed for later use. After the refining process has been completed, the lead is shaped into ingots (either round or square, depending on the customer's specification).

This test plan presents the testing methods and procedures to obtain a representative test of the new baghouse and confirm compliance with the applicable federal NSPS and MACT requirements.

2.0 EMISSION TESTING METHODOLOGY

The rotary furnace and five kettles currently operating, and process fugitive sources (lead taps and molds, and slag taps and molds) are all exhausted to a common set of three settling chambers and a single, eight-module baghouse unit. The new furnace and the additional new kettles and process fugitives associated with new furnace will all be exhausted to a separate eight module baghouse. The new baghouse exhaust stack will be tested for inorganic lead, Particulate Matter, and Sulfur Dioxide emissions following standard EPA methods to determine dry standard cubic feet per minute flow (EPA Methods 1, 2, 3, and 4). A series of three runs or tests will be conducted. The Sulfur Dioxide testing will be conducted over a complete batch run, one EPA method 2 and method 4 run will be completed per hour during the EPA method 6C Sulfur Dioxide test runs.

During the testing of the baghouse exhaust stack, manufacturing operations will be performed under representative operating conditions (as specified in 40 CFR 63.6(f)(2)(iii)(B)).

Sampling will be conducted for at least one hour during each sampling run.

Pertinent manufacturing operating data, including but not limited to amount of materials processed, number and types of equipment operating, and pressure drop across the baghouse modules, and number of operating baghouse modules will be collected during the testing program.

3.0 FIELD TESTING METHODS AND PROCEDURES

3.1 INTRODUCTION

Table 1 presents all the EPA test methods to be employed in completing this stack testing program.

TABLE 1 – EPA TEST METHODS

TEST METHOD NO.	EPA TEST METHOD TITLE
EPA Method 1	Sample and Velocity Traverse for Stationary Sources
EPA Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
EPA Method 3	Gas Analysis for Carbon Dioxide, Excess Air, and Dry Molecular Weight
EPA Method 4	Determination of Moisture Content in Stack Gases
EPA Method 6C	Determination of Sulfur Dioxide
EPA Method 12	Determination of Inorganic Lead Emissions from Stationary Sources

Example sampling data sheets are provided in Appendix A.

3.2 SAMPLE PORT LOCATIONS

The locations of the sampling ports are critical to accurate emission determinations.

Testing will be conducted in the outlet exhaust of the baghouse. In accordance with EPA Reference Method 1, two ports, approximately 3 inches in diameter will be located in the same plane, 90⁰ apart. At each port, the appropriate number of sample points to be used for flow measurement will be determined by EPA Reference Method 1. The distances upstream and downstream from each port to the nearest flow disturbance, and the number of sample traverse points, are summarized and depicted in the following Figures and Tables:

Figure 1 – Baghouse Exhaust Sample Port Locations

Table 2 – Sample Traverse Points – Baghouse Exhaust

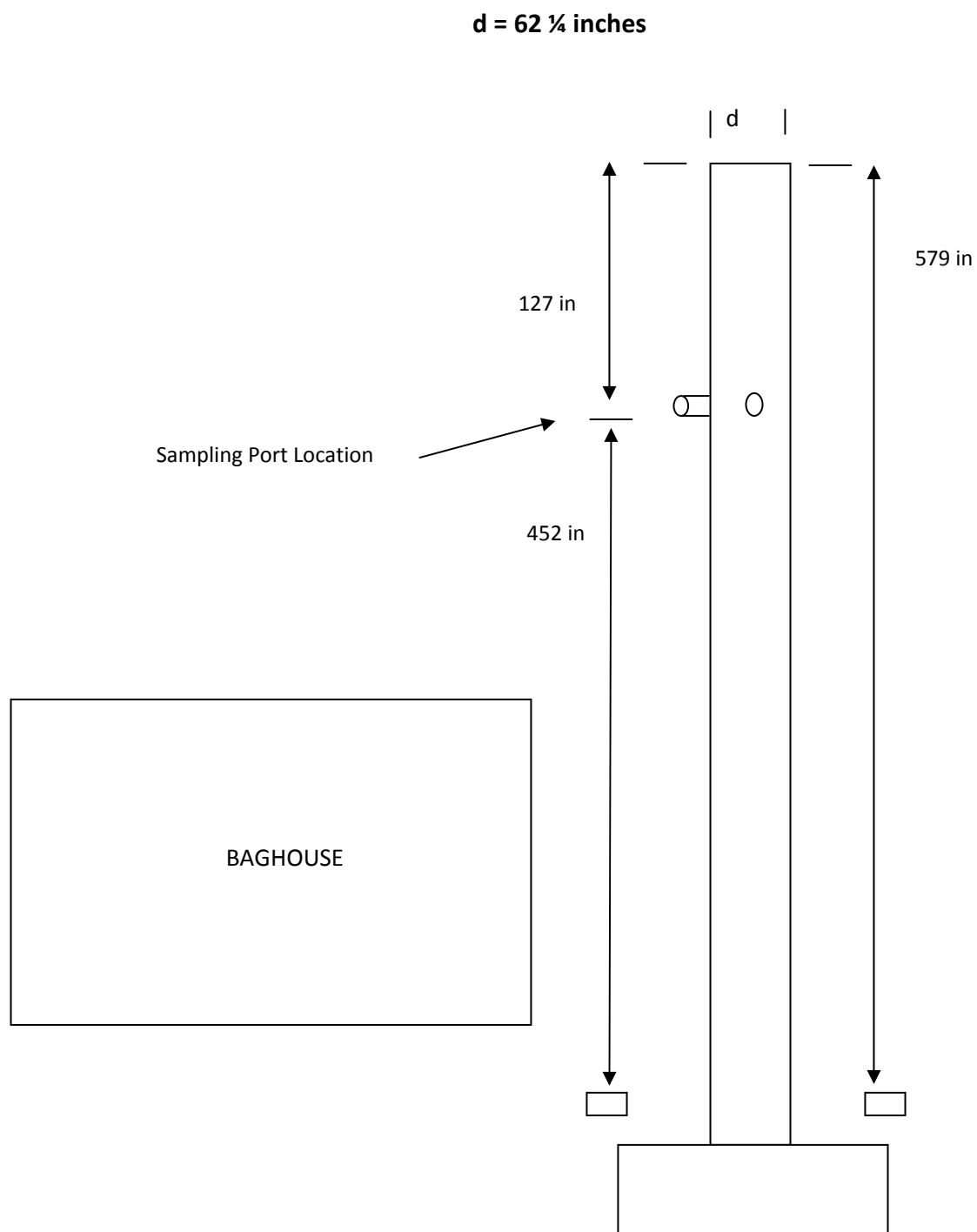


Figure 1 – Baghouse Exhaust Stack Battery
Battery Recycling Company
Arecibo, Puerto Rico

Table 2
Sampling Traverse Points
Baghouse Exhaust

Stack Diameter (inches)	62.25
Distance Downstream from Flow Disturbance ⁽¹⁾ (inches)	452
(duct diameters)	7.26
Distance Upstream from Flow Disturbance ⁽²⁾ (inches)	127
(duct diameters)	2.04
No. of sampling traverse points (total) ⁽³⁾	12
Sample point locations (per port) (inches) ⁽⁴⁾ (less port length)	
Point 1	2.7
Point 2	9.1
Point 3	18.4
Point 4	43.8
Point 5	53.2
Point 6	59.5

(1) Distance B of Figure 1-1 in 40 CFR Part 60, Appendix A, Method 1.

(2) Distance A of Figure 1-1 in 40 CFR Part 60, Appendix A, Method 1.

(3) Calculated using Figure 1-1 in 40 CFR Part 60, Appendix A, Method 1

(4) Calculated using Table 1-2 in 40 CFR Part 60, Appendix A, Method 1.

3.3 GAS FLOW AND TEMPERATURE MEASUREMENTS

Gas flow and temperature determinations will be conducted at the baghouse exhaust stack in accordance with EPA Reference Method 1, *Sample and Velocity Traverses for Stationary Sources* and EPA Reference Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate*. Gas flow and temperature determinations will be conducted simultaneously with each test run. Each sampling location will be checked for the presence of cyclonic flow prior to initiating the three test runs. If cyclonic flow is present in the exhaust gases, the procedures in Section 11 of EPA Reference Method 5, *Determination of Particulate Emissions from Stationary Sources* for sampling particulate matter in exhaust stacks with cyclonic flow will be used.

3.4 MOLECULAR WEIGHT DETERMINATIONS

Molecular weight determinations will be conducted at the baghouse exhaust stack in accordance with EPA Reference Method 3, *Gas Analysis for Carbon Dioxide, Excess Air, and Dry Molecular Weight*. An Orsat gas analyzer (or equivalent) will be used to determine the molecular weight of the outlet gases. The following parameters will be measured to calculate molecular weight: volume percent carbon dioxide (CO₂) and oxygen (O₂) and Nitrogen (N₂). Molecular weight determination will be conducted simultaneously with each test run.

3.5 MOISTURE DETERMINATIONS

Moisture determinations will be conducted at the sampling ports in accordance with EPA Reference Method 4, *Determination of Moisture Content in Stack Gases*. Moisture determination will be conducted simultaneously with each test run.

3.6 INORGANIC LEAD TESTING

Three one-hour test runs will be conducted at the baghouse exhaust stack to determine the concentration and emission rate of total inorganic lead in accordance with EPA Reference Method 12, *Determination of Inorganic Lead Emissions from Stationary Sources*.

3.7 SULFUR DIOXIDE (SO₂) DETERMINATION

The SO₂ concentrations will be sampled and determined using an API Model 100 ultraviolet fluorescence analyzer. The SO₂ sampling will conform to procedures presented in 40 CFR 60, Appendix A, method 6C. The concentration of SO₂ will be reported in ppmv.

3.8 HOOD FACE VELOCITIES USING A PROPELLER ANEMOMETER

The face velocities at the hood opening to the rotary furnace and at the opening to each kettle operating during the testing period will be measured using a propeller anemometer. The face velocities will be measured with the doors open in a manner comparable to normal operating conditions. The measurements will be conducted at multiple points around the door openings and averaged for each source.

The locations that will be tested are as follows:

- 1 Kettle # 1 Trough (multiple areas around the trough)
- 2 Kettle # 2 (multiple areas around the kettle door)
- 3 Kettle # 3 (multiple areas around the kettle door)
- 4 Kettle # 4 (multiple areas around the kettle door)
- 5 Kettle # 5 (multiple areas around the kettle door)
- 6 Furnace (multiple door configurations at multiple locations)
- 7 Blower (multiple areas around the unit)

3.9 OPERATING DATA

The following process parameters will be monitored and recorded during the tests:

- Charge makeup (kettles and furnace)
- Charge rates (kettles and furnace)
- Batch records
- Pressure drop across baghouse modules
- Number of operating baghouse modules

3.10 SAMPLING RESULTS

The sampling program will yield the following information at a minimum:

- Gas flow – actual cubic feet per minute (acfm) and dry standard cubic feet per minute (dscfm)
- Moisture content of the gas stream (percent by volume)
- Exhaust gas temperature (°F)
- Exhaust gas analysis – volume percent of oxygen, carbon dioxide, and nitrogen
- Lead emissions – grains per dry standard cubic foot and pounds per hour

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

4.1 PROGRAM QUALITY CONTROL

All Quality Assurance and Quality Control (QA/QC) requirements as stated in the applicable methods will be followed, including the following:

1. Leak checks of all sampling trains
2. Refrigeration of samples, as appropriate
3. Analyses of sample blanks, as appropriate
4. Proper cleaning of all glassware
5. Appropriate laboratory QA/QC

As required by 40 CFR §63.7, a performance audit sample for lead will be analyzed during the performance test unless this requirement is waived by EPA/PREQB for this testing program.

4.2 EQUIPMENT CALIBRATION

In accordance with accepted procedures published by EPA, all gas volume metering equipment and temperature measuring equipment will be calibrated prior to the test date. In addition, the nozzle diameters, barometer, and thermocouples utilized will be calibrated prior to testing. The pitot tubes to be used will be inspected for compliance with EPA Reference Method 2. All calibration data will be presented to the onsite observer prior to emission testing, if requested by PREQB.

5.0 TESTING SCHEDULE

Rule 106(D) requires that notification must be provided to PREQB at least 15 days prior to the test in order to give the agency the opportunity to have an observer present. The EQB has been delegated to implementation of the federal MACT requirements. The testing is scheduled to begin on June 29, 2010. As per previous conversations with EPA Region II, BRC will provide the Caribbean Environmental Protection Division as much notice as possible so that EPA can coordinate the presence of an observer, if deemed necessary.

6.0 REPORT PREPARATION

Within 30 days after the Lab analysis is received, two copies of the emission test report will be submitted to the PREQB. The emission test report will include at a minimum, the following:

1. Description of the project
2. Tabulation of the field and laboratory data
3. Tabulation of the process operating data recorded during the testing program
4. Tabulation of the emission test results including sampling rates, Lead emission rates, and other relevant sampling data.
5. All laboratory data, including blanks
6. All equipment calibration data sheets

APPENDIX A
TYPICAL FIELD DATA SHEETS

Operator Signature: _____



TEST LAB DATA SHEET

PROJECT: _____
SOURCE: _____
TRAIN I.D. _____
COLLECTED BY: _____

PROJECT NO.: _____
TEST DATE: _____
TEST NO.: _____
CHKD BY: _____

CONDENSATION

IMPINGER NO.	INITIAL VOL., ml/g	FINAL VOL., ml/g	NET GAIN, ml/g
1			0
2			0
3			0
4			0
5			0
6			0
7			0
TOTAL	0	0	0

PARTICULATE

SAMPLE I.D. NO.	INITIAL WT., g	FINIAL WT., g	NET WT., g
PROBE WASH			0
REAGENT BLANK			0
CORRECTED PROBE WASH *			0
FILTER # 1			0
FILTER # 2			0
IMPINGERS			0

* subtract reagent blank from probe wash

TOTAL PARTICULATED COLLECTED

PARTICULATE COLLECTED (excluding impinger catch)
PARTICULATE COLLECTED (including impinger catch)

QA PROBE WASH (as required)

SAMPLE I.D. NO.	INITIAL WT., g	FINIAL WT., g	NET WT., g

COMMENTS:

VISIBLE EMISSION OBSERVATION FORM

Company Name		
Location		
City	State	Zip
Process Equipment		Operating Mode
Control Equipment		Operating Mode
Describe Emission Point		
Height of Emission Point	Height Relative to Observer	
	Start End	
Distance to Emission Point	Direction to Emission Point	
Start End	Start End	
Vertical Angle to Observation Pt.	Direction to Observation Point	
Start End	Start End	
Describe Emissions		
Start End		
Emission Color	If Water Droplet Plume (Circle)	
Start End	Attached Detached N/A	
Point In The Plume At Which Opacity Was Determined		
Start End		
Describe Plume Background		
Start End		
Background Color	Sky Condition	
Start End	Start End	
Wind Speed	Wind Direction	
Start End	Start End	
Ambient Temp	Wet Bulb Temp	RH Percent
Start End		

SOURCE LAYOUT SKETCH

EMISSION OBSERVATION POINT

STACK WITH PLUME

SUN

WIND

OBSERVER'S POSITION

140°

SUN LOCATION LINE

DRAW NORTH ARROW

Additional Information

Observation Date		Start Time				End Time
Sec	Min	0	15	30	45	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Observer's Name (Print)	
Observer's Signature	Date
Organization	
Certified by	Date
Continue on reverse side	

Min \ Sec	0	15	30	45	Comments
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Additional Information



TEST LAB DATA SHEET

PROJECT: _____

JOB NO.: _____

SOURCE: _____

DATE: _____

TRAIN I.D.: _____

TEST NO.: RUN - 1

COLLECTED BY: _____

CHKD. BY: _____

CONDENSATION

IMPINGER NO.	INITIAL VOL., ml/g	FINAL VOL., ml/g	NET GAIN, ml/g
1			
2			
3			
4			
5			
6			
7			
TOTAL			



STACK TEST CALCULATIONS

Project: <u>Client</u>	Barom. Psr.: <u>27.88</u>	Calculated
Project No.: <u>1</u>	Static Psr.: <u>-0.2</u>	Ps: <u>27.865</u>
Source: <u>Kiln #2</u>	Delta H @: <u>1.67</u>	As: <u>77.887</u>
Run No.: <u>1</u>	Gamma: <u>1.004</u>	An: <u>0.000398</u>
Date: <u>5/4/2006</u>	Pitot Coef.: <u>0.84</u>	
Sample Volume: <u>39.35</u>	Stack Dia.: <u>119.5</u> ,in.	
Sample Time: <u>60</u>	Nozzle Dia.: <u>0.27</u> ,in.	
O2 Conc.: <u>13</u>	H2O Gain: <u>22.4</u> ,ml	
CO2 Conc.: <u>8</u>	Part. Weight: <u>0.0041</u> ,g	

TRAVERSE POINT NUMBER	VELOCITY DELTA P		DELTA H	DRY GAS METER TEMPERATURE		STACK TEMP.
	Actual	Sq. Root		Inlet	Outlet	
1	0.42	0.648074	1.5	91		321
2	0.35	0.591608	1.2	91		319
3	0.4	0.632456	1.4	93		322
4	0.4	0.632456	1.4	93		313
5	0.35	0.591608	1.2	95		313
6	0.3	0.547723	1.1	96		317
7	0.35	0.591608	1.2	97		330
8	0.28	0.52915	1	97		344
9	0.28	0.52915	1	97		350
10	0.3	0.547723	1.1	97		363
11	0.28	0.52915	1	99		356
12	0.32	0.565685	1.15	99		355
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
AVERAGE	0.3358333	0.578033	1.1875	95.41667		333.5833

Project: Client
Project No: 1
Source: Kiln #2
Run No.: 1

Stack Sampling Calculations

Volume of Water Collected

$$V_{wstd} = (V_{I0})(0.04707)$$

$$V_{wstd} = 1.05 \text{ cubic feet}$$

Volume of Gas Metered, Standard Conditions

$$V_{mstd} = ((17.64) (V_m)(P_b + \Delta H/13.6)(\gamma))/T_{rr}$$

$$V_{mstd} = 35.092 \text{ cubic feet}$$

Moisture Content

$$B_{wo} = V_{wstd}/(V_{mstd} + V_{wstd})$$

$$B_{wo} = 0.03$$

Molecular Weight of the Dry Gas Stream

$$M_d = (.44)(\%CO_2) + (.32)(\%O_2) + (.28)(\%CO + \%N_2)$$

$$M_d = 29.8$$

Molecular Weight of Stack Gas

$$M_s = (M_d(1 - B_{wo}) + 18(b_{wo}))$$

$$M_s = 29.5$$

Velocity of Stack Gas

$$V_s = 174 C_p (\Delta P \text{ sq.ft.}) / ((T_s + 459.6) \times 29.92 \times 28.96 / P_s / M_s)^{.5}$$

$$V_s = 2,444.7 \text{ ft/min}$$

Total Flow of Stack Gas

$$Q_a = A_s \times V_s$$

$$Q_a = 190,411.54 \text{ ACFM}$$

$$Q_s = Q_a \times 528 / T_s \times P_s / 29.92$$

$$Q_s = 117,987.69 \text{ SCFM}$$

$$Q_{std} = Q_s (1 - B_{wo})$$

$$Q_{std} = 114,546.07 \text{ DSCFM}$$

$$V_{sstd} = Q_{std} / A_s$$

$$V_{sstd} = 1470.68 \text{ ft/min}$$

Percent Isokinetic

$$I_s = V_{mstd} / (A_n \times \text{Time} \times V_{sstd})$$

$$I_s = 1.00$$

Particulate Concentration

$$C_s = (15.43)(M_n) / V_{mstd}$$

$$C_s = 0.0018$$

Particulate Mass Rate

$$P_{mr} = (M_n)(Q_{std})(60) / (V_{mstd})(453.6)$$

$$P_{mr} = 1.77$$